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David C. Oren &

Haroldo Guerreiro de Albuquerque

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Priority Areas for New Avian Collections in Brazilian Amazonia

David C. Oren[1]

Haroldo Guerreiro de Albuquerque[1, 2]

ABSTRACT — Priorities for new bird collections in Brazilian Amazonia are identified using 150 km radii drawn around recorded avian collecting sites. In drawing the radii, there is explicit recognition of rivers as biogeographical barriers. The majority of the region is shown to be high priority for new avian studies, including many areas undergoing rapid deforestation.

KEY WORDS: Birds, Amazonia, Brazil, Biogeography.

RESUMO — Uma técnica que usa raios de 150 km que se originam em sítios de coleta de espécimes de aves na Amazônia brasileira é utilizada para estabelecer prioridades para novas coletas ornitológicas. Ao traçar os raios, reconhecemos explicitamente a importância de rios como barreiras biogeográficas. A maior parte da região aparece como sendo de alta prioridade para novos estudos ornitológicos, inclusive muitas áreas que atualmente sofrem altas taxas de desmatamento.

PALAVRAS-CHAVE: Aves, Amazônia, Brasil, Biogeografia.

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[1] Museu Paraense Emílio Goeldi — CNPq, Departamento de Zoologia, C.P. 399, CEP 66.040 Belém, Pará, Brasil.

[2] Bolsista de Aperfeiçoamento do CNPq.

INTRODUCTION

The geographical distribution of localities where birds have been collected in the Brazilian Amazon is extremely uneven. Haffer (1974) provides the best review of collecting stations in lowland South America to date, including a very useful gazetteer. Most of the localities he notes represent material that has never been published, deposited in museums primarily in the northern hemisphere. The great majority of collecting localities are located along rivers, reflecting their role as the region's natural highways and the difficulty, until recently, of penetrating the vast interfluvial interior. In this paper, we attempt to establish geographical priorities for new collections of bird specimens in Brazilian Amazonia, based on the location of the sites where collections have already been made.

METHODS

The first step in the analysis of priority areas for avian collections in Brazilian Amazonia consisted of up-dating Haffer's (1974) map, by adding sites studied since its publication through 1987, and including a few which had been over-looked. We used the criterion that at least 100 specimens had to have been collected at a site for it to appear on the up-dated map. The majority of these new sites were studied by ornithological research teams from the Museu Paraense Emílio Goeldi, Belém, Brazil. The definition of "Brazilian Amazonia" used here is that of the Brazilian Government's so-called "Legal Amazonia," consisting of Acre, Amapá, Amazonas, western Maranhão, northern Mato Grosso, Pará, Rondônia, Roraima, and Tocantins (Fig. 1).

The second step involved drawing a 150 km radius around each locality, but taking into account the presence of rivers. Major rivers are important biogeographical barriers in Amazonia (Sick 1966). A collection of birds made on the right bank of the Rio Tapajós, for example, tells us little about the avifauna on the left bank. For this reason, the radius of 150 km used for analysis includes only that part on the same side of major rivers as that where the collection was made.

Priority areas were established at three levels: first, second, and low priority. First priority areas are those where there is no avian collecting site within 150 km. Second priority areas are those where there is only a single collecting site within 150 km. Areas considered low priority for this analysis are those that contain two or more collecting localities within a 150 km radius.

RESULTS

Collecting localities for birds in Brazilian Amazonia are plotted in Figure 2. Table 1 is a gazetteer of the new localities added since Haffer's (1974) work.

Figure 3 defines the areas considered first priority for new ornithological collections. Figure 4 indicates the areas of second priority. In Figure 5, areas of low priority are shaded, indicating as white both first and second priority regions for new avian collections.

First Priority

Well over half of the Brazilian Amazon appears in Figure 3 as first priority for new ornithological collections. Among the largest areas defined as virtually unknown, are western Marajó Island, most of the state of Roraima in northernmost Brazil, the northern parts of Pará north of the Amazon, almost all of Acre state and the western part of the state of Amazonas. In addition, the southeastern part of Amazonas state, most of Mato Grosso, southern and western Rondônia, the south-central part of Pará state, virtually all of Tocantins state, and southern Maranhão also appear as first priority.

First and Second Priorities Combined

Figure 5 indicates in hatching the areas where there are at least two collecting sites for birds within a 150 km radius. These areas can be considered to be relatively well-known. There are very few such places: eastern Pará and western Maranhão; southern and northern Amapá; the middle and lower Rio Tapajós; the upper Rio Negro; the lower Solimões; easternmost Acre and adjacent Amazonas and Rondônia; a part of central Rondônia; and small areas in central-eastern Mato Grosso.

DISCUSSION

Birds are generally considered the best known of South American vertebrates (Heyer 1988), although the results of this study reveal enormous lacunae in our knowledge of the distribution of these creatures. There are areas of thousands of square kilometers where there have been no avian studies to date. Most alarming, many of the areas identified as priority are suffering from rapid deforestation and environmental degradation. The entire southern tier of Brazilian Amazonia from Acre and Rondônia through Mato Grosso, southeastern Pará, Tocantins and Maranhão is rapidly changing through human activity. At the same time, it remains virtually unknown, even in the case of the "best known" animal group, that is, birds. There is an urgent need to accelerate and expand the study of the biological wealth of these regions while adequate and representative stands of the original vegetation can still be located.

Comments on the grid square technique

Most studies which look at the geographical coverage of data on plants and animals in tropical South America divide the region into 1° x 1° or 2° x 2° squares, then plot effort per grid unit (*e.g.*, Prance 1982, Heyer 1988). This methodology, although simple to execute and providing good results over much of the Amazon Basin, can produce serious pitfalls in particular regions. The eastern two-thirds of Marajó Island, for example, are in the same two degree grid square as the city of Belém, Pará. Because virtually every naturalist who has ever set foot in the Brazilian Amazon has collected in Belém, this grid square shows up as one of the best studied in the region. Marajó Island, although of huge dimensions and readily accessible for well over a century, has been very poorly studied biologically, however. The two degree grid square technique leads one to imagine that Marajó *and* Belém are well-studied, when only the latter has a privileged data base. This would be of little consequence if both Belém and Marajó supported similar fauna and flora. Belém, however, is a region of tidal igapó, terra firme and secondary forests. Marajó supports extensive mangrove swamps, seasonally flooded grasslands, and beach habitats, in addition to tracts of the same ecosystems common around Belém. Furthermore, preliminary analysis of Marajó's forest avifauna indicates a complex mixture of elements in common with Amapá, the Tocantins-Xingú interfluvium and the district of Belém. With the two degree grid square technique, the need for new and extensive

research effort on Marajó is hidden by the coincidental geographical proximity of the island to Amazonia's best-studied locality.

In future studies of the geographical distribution of research effort, we suggest that the explicit recognition of rivers as barriers be observed, using the same or an adapted methodology based on the technique utilized here. If there is no alternative to the use of grids (in the case of certain computer programs, for example), we suggest that the grids be no more than one degree square on a side. Two degree grids introduce so many potential errors that they should probably be abandoned as a technique in mapping botanical and zoological research effort in Brazilian Amazonia.

Table 1. Gazetteer of Localities of Recent Ornithological Collections in Amazonian Brazil.

No.	Locality
	Amazonas
1 -	Pov. Santa Cruz, Turí Igarapé, tributary of Rio Papuri
2 -	Toototobi (Posto Indígena)
3 -	Pedra do Gavião
4 -	Vista Alegre, Rio Aripuanã, mouth of Rio Guariba
	Rondônia
5 -	Cachoeira Nazaré
6 -	Ouro Preto d'Oeste, linha 62, km 16, Rio Paraíso
7 -	Ji-Paraná
8 -	Alvorada d'Oeste
	Mato Grosso
9 -	Posto Humboldt, Rio Aripuanã
10 -	Chapada dos Guimarães, Escola Buriti
11 -	Rio Peixoto de Azevedo
	Pará
12 -	Rio Paru do Leste (Aldeia Apalaí)
13 -	Rio Paru do Leste (Igarapé Castanheira)
14 -	Serra dos Carajás, Serra Norte
15 -	Cachoeira do Arari
16 -	Ponta de Pedras
17 -	Marapanim
18 -	Santa Rosa, Munc. Vigia
19 -	Pedral and Bacaba, upper Rio Guamá
	Pará (cont.)
20 -	Tomé-açu
21 -	Tucuruí + Vale do Caraipé
22 -	Highway PA-263, km 18
23 -	Canoal, 35 km south of Tucuruí dam
23a -	Sítio Calandrini, left bank Rio Tocantins
24 -	Jacundá
25 -	12 km so. & across from Jacundá
26 -	Rio Sororó, Munc. Marabá
	Amapá
27 -	Igarapé Novo (Rio Iratapuru)
28 -	Mazagão
29 -	Cachoeira Santo Antônio, Rio Jarí
	Maranhão
30 -	Pedra Chata, Rio Gurupí
31 -	Aldeia Zé Gurupi (Urutawi-Rendá)
32 -	Fazenda Santa Bárbara
33 -	Buriticupu
34 -	Serra da Conceição, Munc. Amarante
35 -	Fazenda Canto da Onça, Munc. Grajaú
36 -	Fazenda São Francisco, Munc. Lago Verde
37 -	Tun-tun

Figure 1. Political divisions and major rivers in Brazilian Amazonia.
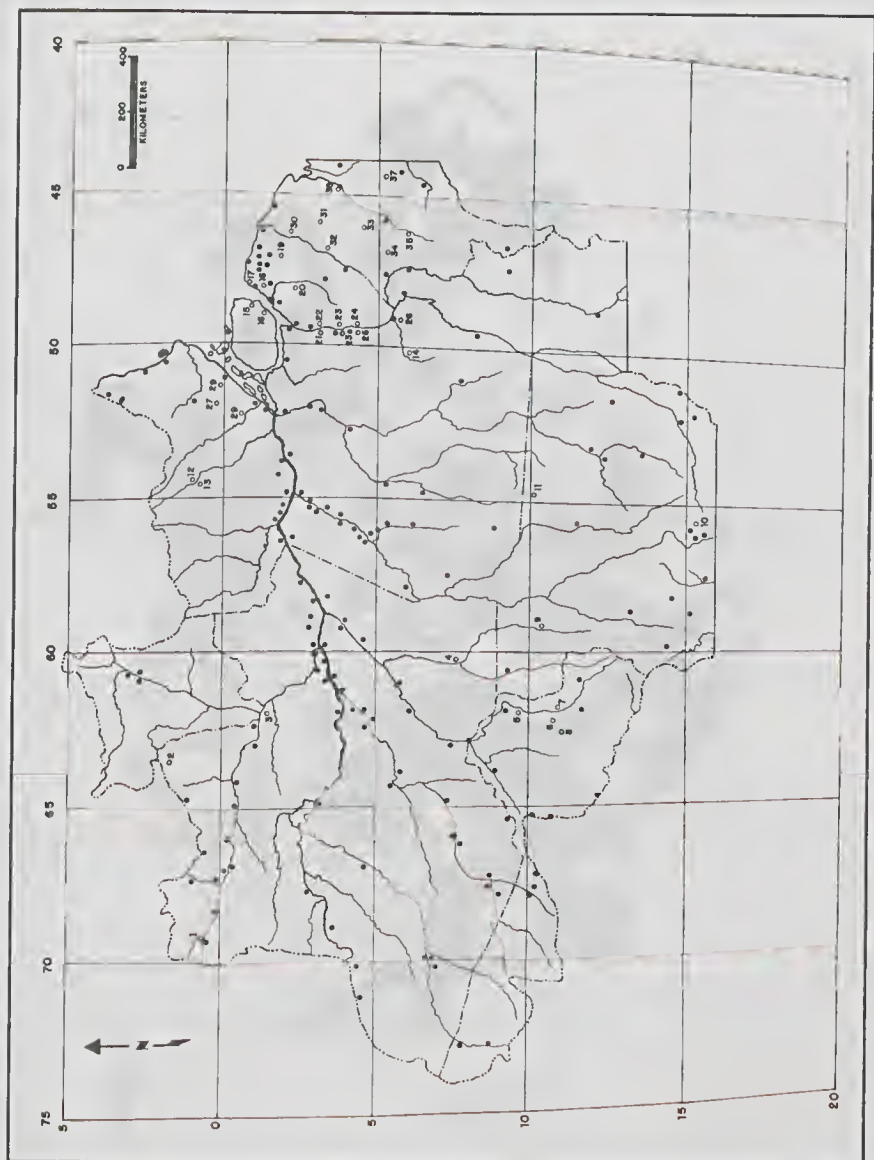
Figure 2. Major ornithological collecting sites in Brazilian Amazonia. Black circles represent sites cited by Haffer (1974). Hollow circles are new sites included in the gazetteer of Table 1.
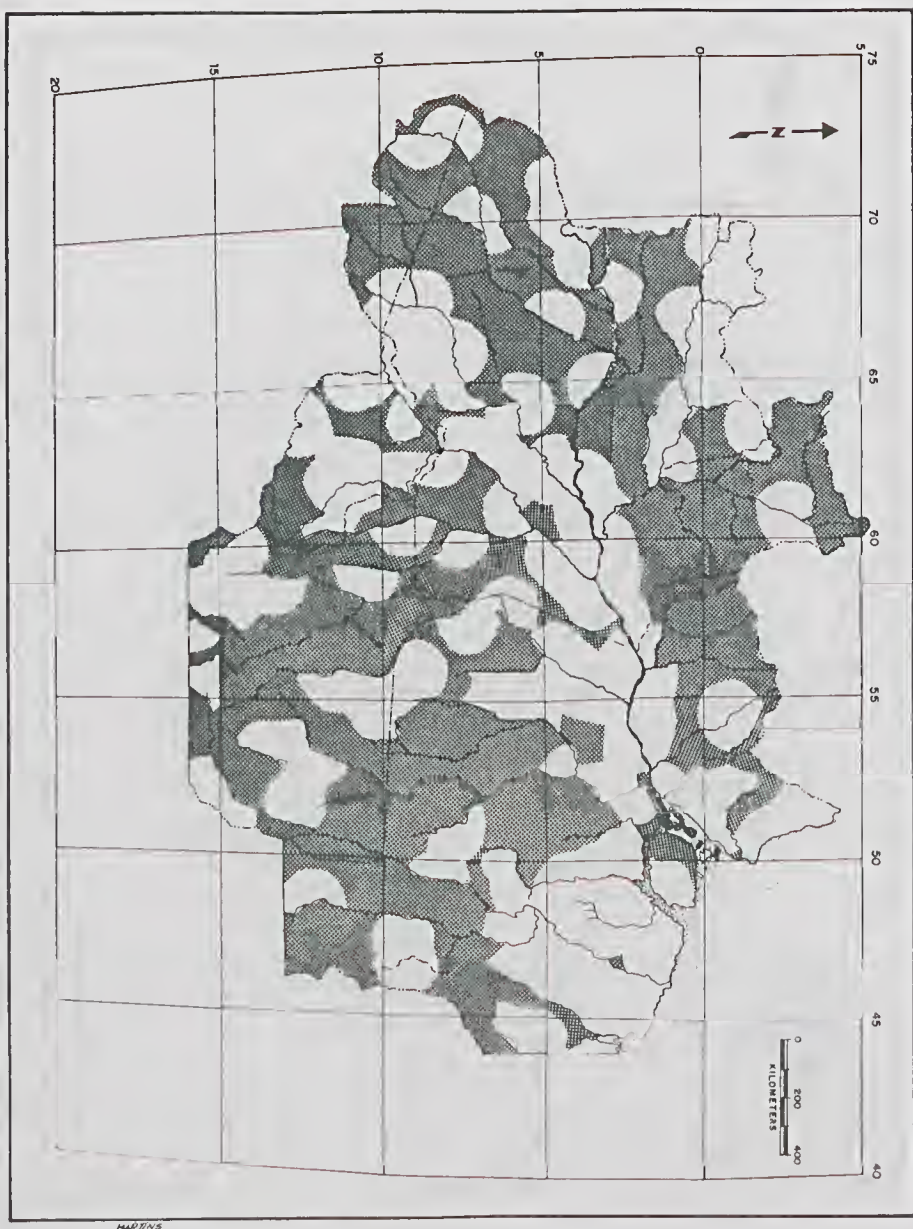
Figure 3. Hatching marks regions indicated as first priority for new ornithological collections.
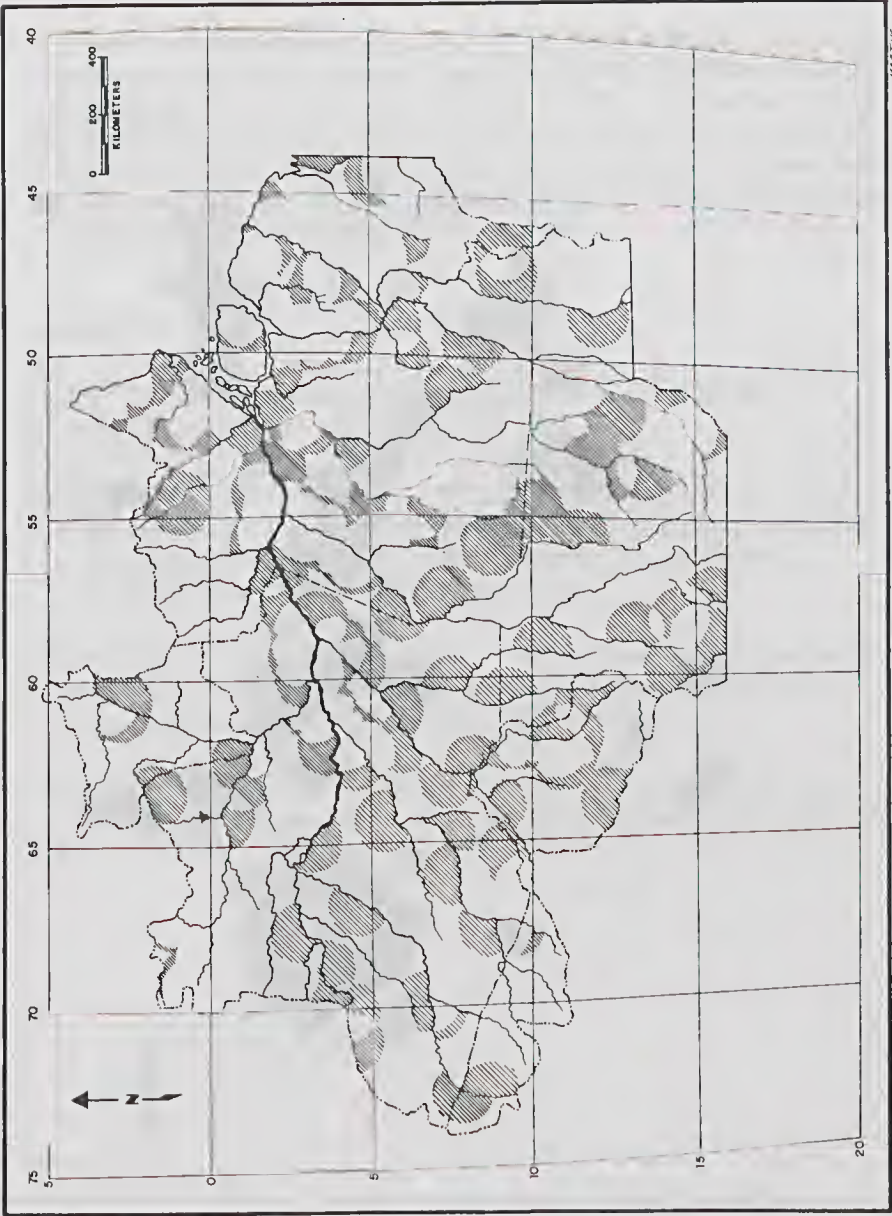
Figure 4. Hatching marks regions indicated as second priority for new ornithological collections.
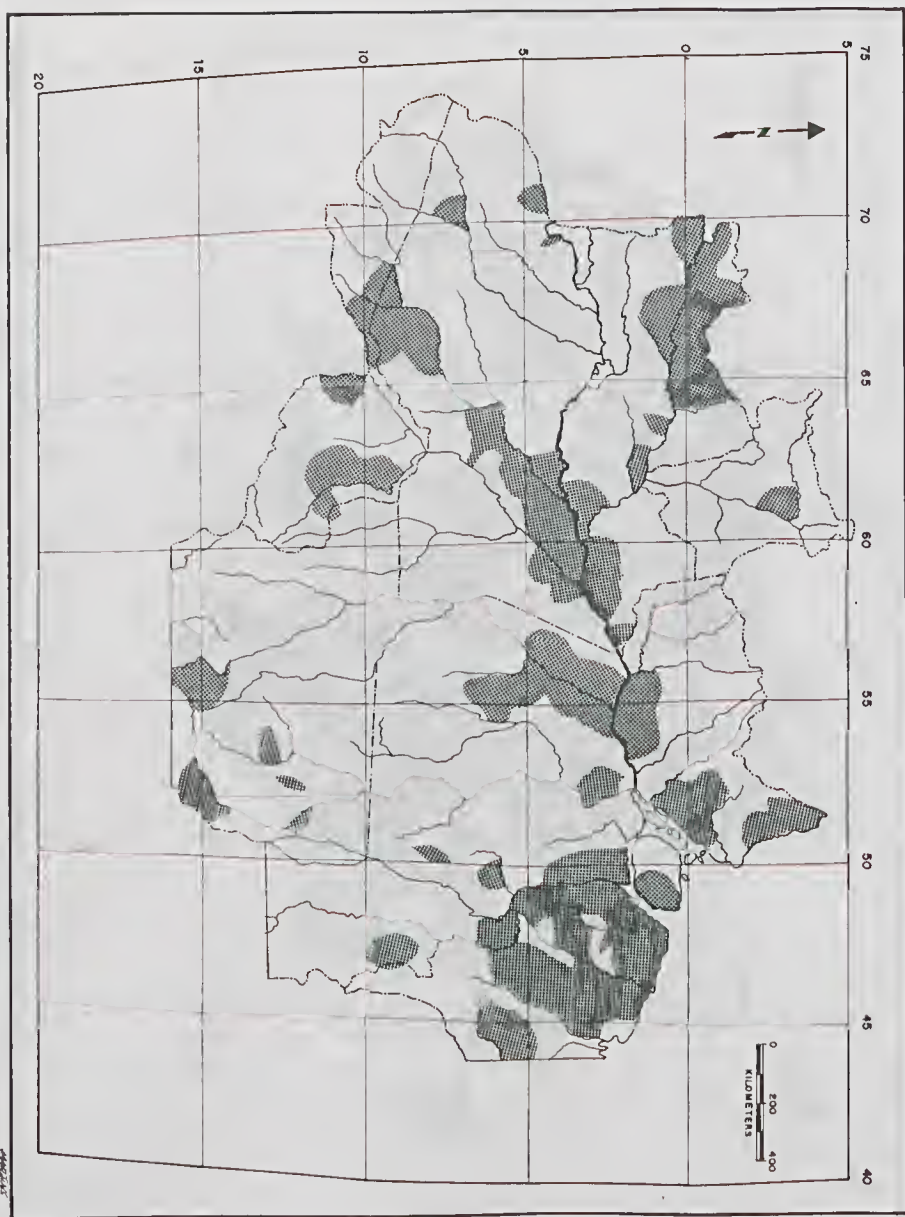
Figure 5. Hatching marks low priority regions for new ornithological collections.

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Campus de Pesquisa — Av. Perimetral. Guamá
Caixa Postal 399. Telex: (091) 1419. Telefones: Parque (091) 224-9233
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